IN THE SPECIFICATION:

The specification as amended below with replacement paragraphs shows added text with underlining and deleted text with ~~strikethrough~~.

Please INSERT the paragraph after the TITLE:

This is a divisional of U.S. Serial No. 09/467,759, filed December 19, 1999, now allowed, which is a divisional of U.S. Serial No. 08/835,995, filed April 11, 1997, now U.S. Patent No. 6,584,070, which is a Continuation of U.S. Serial No. 08/510,121, filed August 1, 1995, now abandoned, which is a Continuation of U.S. Serial No. 08/004,134, filed January 13, 1993, now U.S. Patent No. 5,509,007.

Please REPLACE the paragraph beginning at page 1, line 7, with the following paragraph:

The present invention relates to an asynchronous transfer mode (ATM) transmission apparatus for multiplexing coded audio signals into a cell for transmission over a transmission network in an ATM mode.

Please REPLACE the paragraph beginning at page 1, line 11, with the following paragraph:

Research is progressing on the so-called ISDN (integrated services digital network). This is a branch of technologies for concurrently transmitting over a single network multiple pieces of information that ~~are~~ have different ~~in~~ characteristics, such as audio information and dynamic image information. Drawing attention in this area ~~today~~ presently is asynchronous transfer mode (ATM), a switching technique indispensable for implementing a broadened ISDN (B-ISDN). This technique involves dividing communication information into packets called cells of a fixed length for transmission.

Please REPLACE the paragraph beginning at page 1, line 21 and continuing on to page 2, with the following paragraph:

The most commonly utilized method today for coding telephone voice signals in digital format is pulse code modulation (PCM) at a transmission rate of 64 kilobits per second. Where it is desired to lower the transmission rate (also known as the bit rate) without degrading the quality of voice transmitted, one known method employed is ADPCM (adaptive differential pulse code modulation) at a transmission rate of 32 kilobits per second.

Please REPLACE the paragraph beginning at page 2, line 10, with the following paragraph:

Where voice signals are transmitted as communication information, the quality of voice sound deteriorates if the transmission delay time involved is prolonged. Thus there are strict limits as to how long the transmission delay time is allowed to be.

Please REPLACE the paragraph beginning at page 3, line 16, with the following paragraph:

As depicted in Fig. 3, cells generated by the ATM transmission apparatus 4 are each composed of ~~54~~ 53 octets. The first five octets constitute an ATM header 7. The ATM header 7 includes a virtual path identifier (VPI) and a virtual channel identifier (VCI). The remaining 48 octets make up a payload 8 comprising coded information.

Please REPLACE the paragraph beginning at page 3, line 22 and continuing on to page 4, with the following paragraph:

Of the 48 octets constituting the payload, the first octet contains a sequence number identifier (SN) and a data type identifier (IT)~~;~~, the last two octets make up an effective data length identifier (LI) and a cyclic redundancy check identifier (CRC). The remaining 45 octets (i.e., 360 bits) constitute a payload user information part 11 for transmitting the coded information.

Please REPLACE the paragraph beginning at page 5, line 15, with the following paragraph:

It takes 625 microseconds ~~(ms)~~ (μs) for the coder-decoder 41 to generate one item of coded information (i.e., 125 ~~ms~~ μd x 5). That is, a delay time of 22,500 ~~ms~~ μs occurs by the time 36 items of coded information are accumulated in the code buffer 42 (i.e., 625 ~~ms~~ μs x 36). This often makes it difficult to comply with the time constraints on transmission delay under the LD-CELP method. As a result, a serious adverse effect on the quality of the transmitted voice ~~can~~ may occur.

Please REPLACE the paragraph beginning at page 5, line 24 and continuing on to page 6, with the following paragraph:

~~Today~~Presently, there is a possibility that in-house LAN's (local area networks), based on the DQDB (distributed queue dual bus) system proposed under IEEE (Institute of Electrical and Electronics Engineers) 802.6, will gain widespread acceptance. If that happens, the congestion of different types of communication information, ~~6~~ which will ~~result upon~~ affect transmission, can be a severe disadvantage to the system.

Please REPLACE the paragraph beginning at page 7, line 3, with the following paragraph:

Certain kinds of communication information such as motion pictures require synchronism between dynamic image information and audio information when transmitted. Ensuring synchronism between the different kinds of information is necessary so as to keep the received information meaningful. ~~In~~ It may be arranged technically that each cell comprises either audio or image information alone. In that case, a relatively small amount of audio information is in disproportionate contrast with large quantities of dynamic image information. This can result in what is known as image cell drop-out, i.e., the rate ~~at which to transmit~~ of dynamic image information transmission failing to keep up with the rate of audio information transmission . The image cell drop-out can be a major cause of deterioration in image quality.

Please REPLACE the paragraph beginning at page 8, line 1, with the following paragraph:

In carrying out the invention and according to one aspect thereof, there is provided a cell multiplexing apparatus which receives communication information over at least two channels of any one of the same and different kinds, ~~which~~ and assembles the received information into an asynchronous transfer mode cell made of a fixed-length header and a payload, and which transmits the assembled cell. The apparatus comprises~~:~~ call monitoring means for obtaining call setting information from individual items of the communication information~~;~~ and multiplexing means for multiplexing the communication information received over the minimum of two channels into a single asynchronous transfer mode cell of a fixed length in accordance with the call setting information obtained by the call monitoring means.

Please DELETE the entire contents of the paragraph beginning at line 16 at page 8.

~~In Fig. 1, call monitoring means 100 monitors each of the multiple channels 5 for the call setting status in order to select a plurality of channels 5 for which the same cell may be assembled (i.e., for the same destination). Cell multiplexing means 200 takes audio information or ATM cells from the multiple channels 5 selected by the call monitoring means 100, divides the received information or ATM cells, and assembles the divided parts in a multiplexing manner into a new cell (containing a payload 8).~~

Please REPLACE the paragraph beginning at page 9, line 1, with the following paragraph:

In a preferred structure according to the invention, the multiplexing means 200 may multiplex control and alarm information from the channels 5 selected by the call monitoring means together with, say, audio information into a cell. Alternatively, the multiplexing means 200 may assemble a cell using audio signals obtained by converting a plurality of sampled values into a code of a predetermined number of bits. Because the communication information 6 from the multiple channels 5 is multiplexed, as described, into a single cell according to the invention, the transfer delay is minimized.

Please REPLACE the paragraph beginning at page 9, line 18, with the following paragraph:

~~Only the~~ The same kind of communication information (e.g., audio information) may be multiplexed into a single cell. Alternatively, communication information of different characteristics (audio and image information) may be multiplexed into a single cell.

Please INSERT the following paragraph beginning at page 13, after line 15:

In Fig. 1, call monitoring means 100 monitors each of the multiple channels for the call setting status in order to select a plurality of channels 5 for which the same cell may be assembled (i.e., for the same destination). Cell multiplexing means 200 takes audio information or ATM cells from the multiple channels 5 selected by the call monitoring means 100, divides the received information or ATM cells, and assembles the divided parts in a multiplexing manner into a new cell (containing a payload 8).

Please REPLACE the paragraph beginning at page 13, line 17, with the following paragraph:

The first embodiment of the invention is arranged to divide audio information from a plurality of channels into ATM cells 10 of a fixed length each for multiplexing. Fig. 4 depicts the overall system configuration of the first embodiment, Fig. 5 is a block diagram of an ATM transmission apparatus ~~in~~ according to the first embodiment, and Fig. 6 shows the format of an ATM cell used by the first embodiment.

Please REPLACE the paragraph beginning at page 14, line 11, with the following paragraph:

In Fig. 5, call monitors 46 constituting call monitoring means 10 are provided in the ATM transmission apparatus 4. The call monitors 46 are respectively connected to ATM processors 44. Each ATM processor 44 comprises ~~a code buffer 42~~ coder decoders 41, a data multiplexer 36 and an ATM multiplexer 13, the latter two constituting multiplexing means 200.

Please REPLACE the paragraph beginning at page 14, line 24 and continuing on to page 15, with the following paragraph:

In the ATM transmission apparatus 4, the call ~~monitors 46 monitor~~ monitor 46 monitors the call setting information coming from the calling subscribers over the channels (data A - n). From the call setting information, each call monitor 46 obtains the settings needed to determine a virtual path identifier VPI and a virtual channel identifier VCI for the relevant ATM processor 44. The settings are transferred along with identification information of each channel 5 to the data multiplexer 36. The transfer is made to a buffer controller 12 (buffer control means 12) in the data multiplexer 36 via a control line 37 provided independently of the data communication lines.

Please REPLACE the paragraph beginning at page 16, line 12, with the following paragraph:

When the calling subscriber starts transmitting communication information (audio signal in this example), the coder-decoder 41 provided for each channel 5 converts to coded information the audio signal transmitted over the~~channels~~ corresponding channel 5 and through the exchange 1. The conversion is carried out on the basis of the LD-CELP method. The coded information is accumulated in the code buffer 42 of the data multiplexer 36.

Please REPLACE the paragraph beginning at page 17, line 5, with the following paragraph:

In addition, the buffer controller 12 collects through the call ~~monitors~~ monitor 46 the control information on the connection status of six subscribers forming the same group (e.g., on-hook/off-hook information) as well as alarm information in connection therewith. The collected information is stored in a 10-bit control/alarm information area assigned to the six channels 5 in the payload 8.

Please REPLACE the paragraph beginning at page 17, line 12, with the following paragraph:

Five sets of coded information (a total of 50 bits) and control/alarm information (10 bits) are allocated to each of the six channels 5. These sets of coded information constitute part of the 360-bit payload 8.

Please REPLACE the paragraph beginning at page 19, line 12, with the following paragraph:

Concurrently, the code buffer controller 12 reads coded information from the code buffer 42. If ~~ant~~ any of the channels involved is busy with a call, the code buffer controller 12 notifies the ATM multiplexer 13 with only the control signal such as cell transmission path information until an acknowledge signal is received from the opposite exchange. It is only after the opposite exchange 1 acknowledges receipt and completion of the call and its connection that the coded information is transmitted to the ATM multiplexer 13.

Please REPLACE the paragraph beginning at page 20, line 18 and continuing on to page 21, with the following paragraph:

Fig. 11 shows the sequence of operations in effect when call information sent from the ATM transmission apparatus 4 on the calling side is received as the ATM cell 10 by the ATM transmission apparatus 4 on the receiving side. Upon receipt of the ATM cell 10, the ATM multiplexer 13 sends a cell receipt acknowledge signal to the code buffer controller 12 within the receiving-side ATM transmission apparatus 4. In turn, the code buffer controller 12 makes a read request to the ATM multiplexer 13. The read request prompts the ATM multiplexer 13 to read the payload information (coded and control information) from the ATM cell ~~10 and to decode~~ 10. The code buffer controller decodes the channel path~~. The~~ and the decoded channel path information is sent by the code buffer controller 12 to the control signal transmitter-receiver 15. The channel path information received by the control signal transmitter-receiver 15 is sent both to the call ~~monitors~~ monitor units 38 (Fig. 8) and to the transmission path selector 16.

Please REPLACE the paragraph beginning at page 22, line 1, with the following paragraph:

The lower half of Fig. 9 depicts the sequence of operations performed by the ATM transmission apparatus 4 on the called side when the call is acknowledged by the called subscriber. Specifically, when the called-side ATM transmission apparatus 4 receives acknowledge information (acknowledge signal) from the called subscriber, a calf connection signal is extracted by the control signal transmitter-receiver 15 from the received information and is sent to the code buffer controller 12 via the transmission path~~-selector16~~ selector 16. Then in the same sequence as shown in Fig. 10, the coded information is read from the code buffer 42 for cell generation. The payload information is forwarded to the ATM multiplexer 13.

Please REPLACE the paragraph beginning at page 22, line 14, with the following paragraph:

The ATM multiplexer 13 prefixes the header 7 to the payload information. The payload information prefixed with the header 7 is sent to the cross connection multiplexer 45. In turn, the cross connection multiplexer 45 transmits the acknowledge information as an ATM cell 10 to the ATM transmission apparatus 4 on the calling side.

Please REPLACE the paragraph beginning at page 22, line 20 and continuing on to page 23, with the following paragraph:

As described, the first embodiment works roughly as follows: when the code buffers 42 corresponding to the six calls that share a virtual path identifier VPI and a virtual channel identifier VCI have each accumulated five sets of coded information, the data multiplexer 36 (buffer controller 12) in the ATM transmission apparatus 4 starts assembling one set of payload information using separately collected control and alarm information. At this point, it takes 3,125 ~~ms~~ µs (i.e., 625 x 5) for each of the code buffers 42 to accumulate five sets of coded information. That is, the coded information accumulation time with the code buffers 42 is reduced to 5/36 of the time normally calculated with the prior art ATM transmission apparatus 4 (22,500 ~~ms~~ µs).

Please REPLACE the paragraph beginning at page 24, line 12, with the following paragraph:

In Fig. 13, the path identifier 17 acts as a kind of selector. While receiving information in the form of ATM cells 10 from the ATM converters (AAL's), the path identifier 17 detects VPI values from these cells. If ATM cells 10 found destined to the same path based on VPI detection are received within a predetermined period of time, the path identifier 17 inputs these ATM cells into the cell mapping part 18. In Fig. ~~14~~ 15, cells #1 and #2 have the same ~~VIP~~ VPI value.

Please REPLACE the paragraph beginning at page 26, line 1, with the following paragraph:

Fig. 15 illustrates how ATM cells (cells #1, #2, etc.) are related in format to the new ATM cell (cell #A) in connection with the second embodiment. As shown, the VPI and VCI values of the first ATM cell (cell #1) are adopted as those of the new ATM cell 10 (cell #A)~~; the~~. The VCI information of the second and subsequent ATM cells is stored successively into the channel ID part 24. The control information and user information of the ATM cells 10 are placed for each channel into areas of a fixed length each within the user information part 11 of the payload 8 in the new ATM cell 10 (cell #A).

Please REPLACE the paragraph beginning at page 26, line 23 and continuing on to page 27, with the following paragraph:

When a predetermined period of time has elapsed on the timer 20 (i.e., upon time-out), the timer 20 outputs a trigger signal to the cell output part 52 through the cell mapping controller 22. With the trigger signal output, the ~~VIP~~ VPI value is written to the header 7 of the new ATM cell 10 (cell #A) via the cell output part 52. The ATM cell 10 (cell #A) is then output onto the transmission line.

Please REPLACE the paragraph beginning at page 33, line 10, with the following paragraph:

Fig. 21 sketches the overall system configuration of the fifth embodiment. In the in-house setup of Fig. 21, terminals 31 (TE) connected to in-house bus means 28 coming from network transit switching equipment 26 are illustratively multimedia terminals. Each of these terminals incorporates a pair of interface parts 30 that transmit and receive image information, audio information, text data and other data in the form of ATM cells 10. Fig. 22 illustrates an interface part 30 in more detail. As depicted, the interface part 30 (See Fig. 22) comprises an ATM multiplexer 13, a buffer controller 12 and a buffer 54. In each terminal (TE), one interface part 30 is located on the upward-bound bus side and the other interface part 30 on the downward-bound bus side.

Please REPLACE the paragraph beginning at page 34, line 4, with the following paragraph:

What takes place on the transmitting side of the fifth embodiment in Fig. 23 is as follows: data items (A, B, C, ..., N) from terminals are first written to the buffer 54. When a buffer input counter 2302 has counted written data of each of the data items up to a predetermined value, the counter notifies an input transmission rate calculation part ~~3203~~2303 that the predetermined count value of one of the data items is reached. Based on that input count value, the input transmission rate calculation part ~~3203~~ 2303 calculates the transmission rate of the input data and notifies a payload assembly ratio calculation part 2305 of that rate. At the same time, a desired transmission rate request processing part 2304 receives desired transmission rate requests from the terminals (TE) and notifies the payload assembly ratio calculation part 2305 of these requests.

Please REPLACE the paragraph beginning at page 35, line 2, with the following paragraph:

In turn, the read order and amount controller 2306 activates individual input buffer reading ~~parts~~ part 2307 which ~~read~~ reads necessary amounts of data from the buffer 54 in a predetermined order. The read-out data are handed over to a payload data assembly part 2308 of the ATM multiplexer 13.

Please REPLACE the paragraph beginning at page 35, line 16, with the following paragraph:

What takes place on the receiving side of the fifth embodiment in Fig. 24 is as follows: when an ATM cell 10 is received through the in-house bus means 28 <u>(Figs. 21 and 22)</u>, cell receipt information is sent from an ATM header Identification part 2413 to a bus monitoring and processing part 2412 within the ATM multiplexer 13. This causes necessary processing to take place according to the protocol (e.g., DQDB protocol) of the in-house bus means 28.

Please REPLACE the paragraph beginning at page 37, line 2, with the following paragraph:

Fig. 25 is a conceptual view illustrating how ATM cells are multiplexed by the fifth embodiment. In Fig. 25, transmitted information composed of four data types (data A through data D~~;~~ in the upper part of the figure) is shown multiplexed in variable lengths (in the lower part of the figure) within the payload 8 of an ATM cell 10. These four kinds of data (data A - D) may be data for a different channel each (e.g., data A representing image, data B sound, data C text data). The fifth embodiment is particularly~~-effect~~ <u>effective</u> when used with an in-house setup wherein multimedia terminals connected to an in-house LAN are often required to transmit and receive information of different channels in synchronism.

Please REPLACE the paragraph beginning at page 39, line 9, with the following paragraph:

In the ATM cell format shown in Fig. 28, what characterizes the fifth embodiment is that, as mentioned above, the payload user information part 11 is headed by the payload control information part 23 which comprises the first control area 34 and second control area 35. The first and the second control areas 34 and 35 accommodate the DB header and DC header, respectively, as identifiers. The DB header may store up to four identifiers<u>,</u> two bits in length each. The meanings of these identifiers (DCF's) are listed in Fig. 29.

Please REPLACE the paragraph beginning at page 39, line 19, with the following paragraph:

In Fig. 29, a bit string "00" held in-a DCF means that no data is stored in the corresponding payload user information part 11~~;~~, a bit string "01" means that the beginning of transmitted data is stored~~;~~, a bit string "10" means that an intermediate portion of the transmitted data is stored~~;~~ and a bit string "11" means that the end of the transmitted data is stored.